

RENOLD

Gears & Variable Speed

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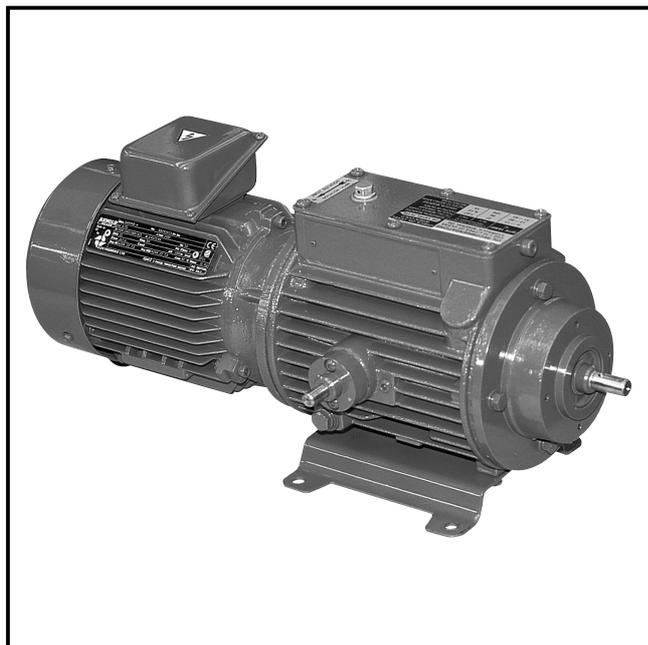
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MK01-MK02 Carter Variator

INSTALLATION & MAINTENANCE INSTRUCTIONS

INSTALLATION, STARTING UP AND ROUTINE MAINTENANCE INSTRUCTIONS

'MK' Type Carter Variators are precision built machines and are subjected to thorough testing before despatch; and if correctly selected and installed in accordance with the following instructions, then reliable service can be expected.

MOUNTING

MK01 & 02 Type variators are normally supplied for either horizontal or vertical mounting, as shown in figs 1 and 2. When other mounting positions are required, full details of applications and proposed mounting position should be submitted for our approval. Supporting structures should be adequately proportioned to resist all directly imposed reaction forces and maintain correct alignment of all drive components. Large flat areas of thin metal should be stiffened to prevent undue noise amplification. Where drives are enclosed within structures and guards, adequate ventilation is essential to ensure reasonable ambient temperature conditions.

OVERLOAD PROTECTION

Our overload protection unit should be fitted whenever there is a known, or suspected, risk of severe and/or sudden shock loads or dead stops. NB: Driving motor overload trips do NOT provide adequate overload protection for the Carter Unit.

OUTPUT DRIVE

Output drive ratios (irrespective of type of power transmission equipment used) should be arranged so that maximum speed of variator and required maximum machine shaft speed are the same, thus ensuring maximum power transmission and speed control efficiency. Both directions of output rotation are possible through operation of the speed control. However, it may be restricted to only one direction by means of internal mechanical stops. Instructions on how to adjust these stops will be given on request.

SHAFT TOLERANCES AND FITTING RECOMMENDATIONS

'MK' Type Variators and RS series reduction gear shafts are manufactured to j6 limits; worm reduction unit shafts to k6. Couplings, pinions and pulleys should incorporate 'taper' bushes or be bored a light keying fit. End thrust may be applied to RS Series and worm reduction unit output shafts - see appropriate catalogue sheets. End thrusts must NOT be applied to the Variator Output Shaft during installation or operation. If the unit is directly coupled to a driven shaft, a flexible coupling must be used and ample clearance allowed between shaft ends. Shaft alignment must be carefully checked and maintained, as mis-alignment puts unnecessary loading on the whole drive, particularly the bearings and oil seals.

OVERHUNG LOADS

Belt drives, spur gears or chain drives etc., may be used in conjunction with 'MK' Type variators, but consideration must be given to the overhung loads that these drives impose on the output shafts. This may be calculated as follows:-

$$\text{Load (N)} = \frac{\text{TORQUE (Nm)} \times 10^3 \times F}{\text{RADIUS (mm)}}$$

$$\text{LOAD (lbf)} = \frac{\text{TORQUE (lbf.in)} \times F}{\text{RADIUS (in)}}$$

1 Newton = 0.2248 lbf

MK01 & 02 TYPE CARTER VARIATORS

Where: RADIUS = Pitch circle radius of chain sprocket spur gear or belt pulley.
and F = Application Factor i.e.

Chain sprocket	- 1,00	Vee/Wedge pulley	- 1,50
Spur Gear	- 1,25	Flat Belt pulley	- 2,00

The maximum permissible shaft loads are given in the table below and are concentrated loads imposed at the centre of the keyway, midway along the shaft length. Any deviation from this position will increase or decrease the amount that can be safely applied.

Carter MK01 & 02 Type Variators: Maximum overhung load = 135 N (30lb)

RS SERIES REDUCTION UNIT

Unit Size	Ratio	Maximum overhung loads		Unit Size	Ratio	Maximum overhung loads		
		N	lb			N	lb	
GMOD	1,563:1	900	202	GMOD cont'd	13,598:1	1880	422	
	1,885:1	930	209		17,035:1	2000	449	
	2,194:1	1000	224		20,773:1	2050	460	
	2,855:1	1090	250		25,937:1	2050	460	
	3,443:1	1160	261		GM1T	25,442:1	3740	840
	4,008:1	1230	277			30,222:1	4200	944
5,188:1	1310	294	39,231:1	4580		1029		
6,216:1	1400	315	46,952:1	4850		1090		
7,497:1	1520	341	56,667:1	5100		1146		
9,426:1	1640	368	69,259:1	5340	1199			
11,349:1	1760	395	86,232:1	5340	1199			

SPEED CONTROLS

Speed control settings are adjustable with the variator running or stationary and frequent or infrequent speed changes can be made without detriment to the unit. The control can be used to positively accelerate or dynamically brake the driven load, providing the main driving motor remains energised.

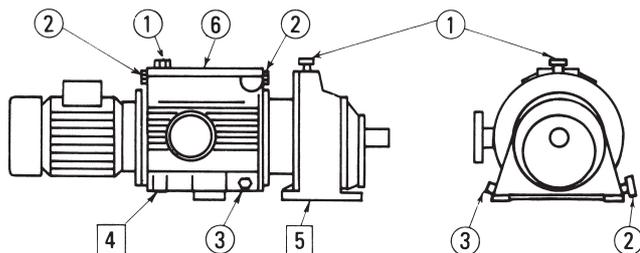
They are usually set up and tested prior to despatch. However, to avoid damage during transit, combined handwheel and speed indicator controls are packed in a protective carton and supplied loose.

Electric remote and electronic controls should be set up in accordance with the appropriate technical data sheets supplied.

OIL LEVELS

When installing MK01 & 02 Type Variators fitted with flange mounted RS Series Reduction Gears it is important to remember that these have SEPARATE OIL SUMPS (see fig 1)

Fig.1 Horizontally mounted



- ① OIL FILLER/ BREATHER PLUGS
- ② OIL LEVEL PLUG
- ③ OIL DRAIN PLUGS
- ④ CARTER VARIATOR
- ⑤ RS SERIES REDUCTION UNIT
- ⑥ OIL RESERVOIR COVER

FILLING VARIATOR - horizontally mounted

Check oil drain plug is in position and tightened. Remove oil level plug and reservoir cover. Fill variator by pouring correct grade of oil into the filler aperture until it leaks from oil level hole.

Replace and tighten down cover and level plug. Subsequent 'topping up' may be done by removing filler/breather plug and fill through aperture.

APPROXIMATE OIL QUANTITIES

Unit Size	Oil Capacities (approx)		
	Litres	Imperial Pints	US Pints
CARTER VARIATORS MK01 & 02	1.5	2.6	3.2
RS SERIES REDUCTION UNIT GMOD	0.4	0.7	0.9
GM1T	0.6	1.1	1.4

RECOMMENDED GRADES OF OIL

Use a straight mineral oil of good quality, preferably with anti-oxidant, anti-foaming, anti-rust, film strength improvement and low pour point additives and with a flat viscosity curve to ensure ease of starting when cold. COMPOUND OILS MUST NOT BE USED. The standard grades of Shell oil suitable for normal ambient temperatures shown below.

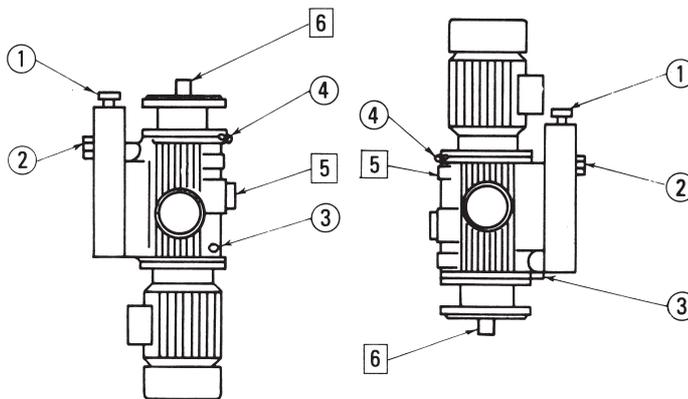
Other standard grades may be used provided they conform to the specification relevant to site conditions. Details available on request.

In exceptional conditions such as extremes of temperature, high humidity, corrosive atmospheres etc., consult your oil supplier for recommendations. These should be based on the oils listed for normal conditions.

SHELL OIL COMPANY - Recommended Grades

AMBIENT TEMP RANGE CENTIGRADE	OIL GRADE	MOUNTING ASSEMBLY
0 - 13	MOBIL DTE13M	MKF VARIATOR WITH DIRECT FLANGED MOTOR
	SHELL TELLUS T100	
13 - 30	MOBIL DTE15M	
	SHELL TELLUS T46	
0 - 43	MOBIL DTE18M	
	SHELL TELLUS T100	
0 - 43	MOBIL GEAR 632	RS SERIES REDUCER FLANGED TO VARIATOR
	SHELL OMALA 320	

Fig.2 Vertically mounted



- ① OIL FILLER/ BREATHER PLUGS
- ② OIL LEVEL PLUG
- ③ OIL DRAIN PLUGS
- ④ OIL VENT PLUG
- ⑤ CARTER VARIATOR
- ⑥ OUTPUT SHAFT

FILLING VARIATOR - vertically mounted

Check oil drain plug is in position and tightened. Remove oil vent plug, level plug and filler plug. Fill variator with correct grade of oil until it leaks from vent hole. Replace vent plug (complete with copper washer) and continue to fill with oil until it leaks from oil level hole. Replace and tighten oil level and filler plugs.

INITIAL STARTING

Before any attempt is made to run the Carter Variator it must be filled with the appropriate quantities and grades of CLEAN oil as detailed above. Note that where flange mounted RS series or worm reduction units are fitted, these have separate oil sumps and require different grades of oil to the variator.

If the Variator requires filling, leave it to stand for 10 minutes, then set the control to zero. (Approx 9 turns of control spindle = Max. forward speed - 0 - Max. reverse speed). Start motor and check rotation. It should be as that indicated on rotation indicator plate fixed to oil reservoir cover (usually clockwise looking on motor fan).

Slowly adjust speed control between half speed and zero (in both output directions if possible) approximately six times, applying a light load to the output shaft. Then run it continuously at half speed for approximately 10 minutes.

The Variator should now be ready for operation. If, however, it fails to reach maximum output speed, or produces excessive noise, the above procedure should be repeated to release air still trapped in the hydraulic system.

WEEKLY MAINTENANCE

Examine oil levels and 'top-up' as required. If regular 'topping up' is required, check shaft seals and all external fastenings for leaks.

OIL CHANGES

Under normal circumstances of temperature and environment, the oil should be changed every 2500 hours or 12 months, whichever is the sooner. Where other working conditions apply consult your oil supplier. Take care to ensure that dirt does not enter unit whilst changing oil. The oil will flow more freely if it is warm (after the drive has been running) and if the reservoir cover or breather/filler plug is removed. Finally, it is advisable to remove, clean and replace oil filter element - located under the reservoir cover - before re-filling the Variator.

OIL LEAKAGE

Where oil leakage is evident, the relevant oil sealing component will need to be renewed as soon as possible. However, oil leakage will in general have no effect on the Variator's performance unless the level in the Variator's sump falls so low that the hydraulic circuit is starved, thus causing eventual drive failure. A weekly check on oil level should prevent this and give an early indication of leakage.

NOTE The instructions under "INITIAL STARTING" should be carried out whenever the oil sealing components have been renewed.

MAJOR OVERHAUL

Eventually an extensive examination and overhaul will be required and this is best carried out at our works where all parts are stocked and, of prime importance, variators can be thoroughly tested before despatch. However, where this is impracticable, detailed instructions for the required procedure are set out in our Service Manual, which is available on request.

For overseas installations, our agents are, in general, equipped to carry out examinations and repairs.